# ART. VII.—A DISCUSSION OF THE RELATION OF THE NERVOUS SYSTEM TO THE UTERUS, WITH SPECIAL REFERENCE TO THE PHENOMENA OF PARTURITION.

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HAVING read, in the April issue for 1875, of THE CHICAGO JOURNAL OF NERVOUS AND MENTAL DISEASES, an interesting article entitled "The Relations of the Nervous System to the Uterus," I regret that I cannot agree with the very able author in his discussion of the causes, which determine the occurrence of parturition at the end of the usual period of gestation. I find myself also unable to accept without some degree of hesitation his very ingenious explanation of the intermittent character of the contractions of the womb during labor.

1. *Why does the gravid uterus for nine months tolerate its contents, and then cast them out?*

Professor Jewell makes the following answer:

"The uterus retains its contents as it does because the neck practically performs the office of a sphincter. It retains them as long as it does, because it requires as a rule the whole period of pregnancy to obliterate the neck in the progressive expansion of the uterus. When it is obliterated as a neck, then the uterus and its contents settle down in the pelvis, and the time for it to expel its contents is at hand. The time required under ordinary circumstances for the obliteration of the cervix is the period of gestation."

Now there can be no very serious objection to the statement that the cervix uteri "practically performs the office of a sphincter;" but if the progressive expansion of the uterus is

attended by a progressive obliteration of that sphincter, and if the existence of a uterine sphincter is the condition which determines the retention of the fœtus, it would seem that cases in which the weakening sphincter failed to accomplish its functions should become more and more frequent as the time of pregnancy advances. On the contrary, obstetrical authors seem quite unanimous in the belief that the early months of pregnancy furnish the period most liable to the accident of untimely uterine evacuation. The authorities, moreover, are not agreed as to the time when obliteration of the neck commences. Some maintain that it is a continuous process, initiated by conception. Others believe that it does not commence before the sixth month. Cazeaux, following Stoltz of Strasburgh, refused to recognize any obliteration of the neck before the last fortnight of pregnancy. During that last fortnight, however, it was the opinion of this distinguished teacher—an opinion which is still copied into all the popular text-books on midwifery—that the neck of the womb was obliterated by the downward pressure of the bag of water.

Upon this declaration of the text-books, Professor Jewell appears to have based his explanation of the cause of the parturient contractions of the womb. The error which I would point out is, therefore, not his, but attaches itself to some of his most distinguished predecessors in the discussion of the causes of labor.

In the year 1861, I had the good fortune to assist Prof. I. E. Taylor, of New York, in his study of the conditions of the cervix uteri during pregnancy. The results of this investigation were published in *The American Medical Times*, vol. iv., p. 342, and are thus summarily stated in *Flint's Physiology*, vol. v., p. 444: "It is a remarkable fact, demonstrated upon the living subject, by Prof. I. E. Taylor, of New York, that the neck of the uterus while it becomes softer and more patulous during pregnancy, does not change its length, even in the very latest stages of utero-gestation. The opinions of obstetricians with regard to the condition of the cervix uteri at the later periods of pregnancy, anterior to the observations of Prof. Taylor were based chiefly upon digital examinations, which are very deceptive. Dr. Taylor's observations, which

are entirely conclusive, were made both with the touch and with the speculum."

I can add my own testimony to the fact that his demonstration of the integrity of the cervix uteri, even after the commencement of labor, was beyond all question; and no one connected with Bellevue Hospital at that time had any doubt that the uterine neck of a pregnant woman was as good a sphincter the day before her delivery as it ever had been. Not unfrequently, in the lying-in ward, I have introduced the speculum, after the commencement of labor pains, and have found a cervix as prominent, as deep, and as impenetrable as it had been when the same patient had been examined days, weeks, or months previously. As labor advanced, the observation of the progressive obliteration of such a cervix formed one of the most interesting duties of the attending physician.

If, then, the *quasi* sphincter of the uterus has been shown to maintain its integrity until, or even after, the actual commencement of the muscular contractions by which the womb is to be evacuated, it becomes necessary, according to Prof. Jewell's hypothesis, to suppose that the muscular fibres of the body of the womb are at length hypertrophied to such a degree that the cervical muscular fibres can no longer react with inhibitory vigor sufficient to continue the state of equilibrium which for nine months has been maintained between the neck and the body. In other words, a point of time is reached when the corporeal muscular actions and reactions through the medium of the nervous apparatus become more powerful than the corresponding cervical actions and reactions. This loss of equilibrium is the commencement of labor. This, if I understand him, is the Professor's actual position, for he seems to assume that when labor is once begun, the obliterated neck, or something occupying its place, is still capable of making, for a considerable time, strong resistance to the expulsive efforts of the body of the womb. But it seems to me that, if we have thus far considered all the conditions of the parturient effort (*corporeal contraction, reflex excitation of cervical fibres, inhibitory action,*) there is really no reason why labor should ever commence. Nothing has been yet shown competent to provoke the initial contraction. Simple

uterine tonicity could never disturb a condition of cervical tonicity; and, as the Professor seems to teach in his explanation of the intermittent character of labor pains, if uterine muscular contraction will, by arousing cervical contraction, inevitably let loose upon itself an inhibitory nervous apparatus, I cannot see why a condition of equilibrium which has been maintained for nine months upon such a basis might not be indefinitely prolonged.

As a matter of fact the uterus "continues to tolerate its contents" *as long as the fœtal envelope forms an integral part of its substance, and no longer.* While Prof. Jewell has very clearly traced the mechanism of uterine expulsive effort, he has apparently allowed its nervous factors to overshadow the less conspicuous, but equally important conditions which contribute to the termination of utero-gestation. I will only refer to the part which is played by the mucous membrane of the cavity of the womb. At first, it gives a point of attachment for the recent ovum. Its expansion forms a covering for the growing egg (*decidua vera, decidua reflexa.*) Ovisac, mucous membrane, uterine wall, are combined to form a single physiological entity. At length, however, a new mucous membrane begins to develope under the decidua vera. Its growth is constant, and at the end of the ninth month it has reduced the fœtal sac to the condition of a foreign body occupying the cavity of the womb. The reflex nervous apparatus of the uterus then becomes aroused, just as it would in the presence of any other foreign body, and a motor stimulus is communicated to the muscular fibres of the organ. The cervical fibres, which communicate with their motor centres by a short circuit, are the first to contract (Cazeaux.) The corporeal fibres, communicating largely with other and more distant nervous centres (Jewell,) take up the contraction later. In this way the conclusion of each pain leaves the mouth of the womb in a condition of progressive expansion—actually pulled open by the corporeal fibres, which continue to contract after the cervical fibres have commenced to relax. If, as Prof. Jewell seems to intimate, the corporeal fibres began to contract before the cervical fibres, the end of each pain would exhibit the womb more tightly closed, and less likely to open

than ever before. But, fortunately, the reverse of this process is true, and dilatation progresses until the neck of the womb is "obliterated." Every uterine obstacle removed, the head of the child enters the vagina, where it serves to arouse an ever widening circle of reflex activities until parturition is completed by the birth of the infant. In short, delivery takes place when it does, not because nine months are necessary to obliterate the neck of the womb, but because nine months are needed to ripen the ovum into a body foreign to the cavity of the womb.

II. *Why are labor pains intermittent?*

The Professor explains as follows:

The "sensory centre of the neck is supposed to be connected, also, with the motor centre for the body of the womb, so that the impressions received by 2" (*sensory centre of neck*) "are not only sent to 3" (*motor centre of neck,*) "but to *e*" (*motor centre for womb.*) But why to *e?* Simply for *inhibitory* purposes—or to *arrest* its action more or less gradually.

"As a rule, which has its exceptions, so long as the neck remains unobliterated, expulsive contractions of the body of the uterus cannot occur to any marked extent, without (1) rousing contractions of the neck, as I have supposed; and (2) causing, especially if pain is excited in the neck or soft sensitive parts, inhibitory action, or an action of arrest, exerted by the centre 2 on *e*, the latter being the motor centre for the body of the womb. If it were not for this inhibitory action, exerted by the sensory centres for the neck and vagina, etc., strong and long-continued contractions of the uterus might, during labor, lead in most instances to damage of the soft parts. * * * This is why the uterine contractions are periodical, or rhythmical."

No one will feel disposed to deny that this hypothesis supplies for the phenomena of inhibitory action an explanation which is perfectly satisfactory in such cases as the cessation of labor pains when "the bladder, partly filled with urine, is caught by the head of the child against the os pubis, in such a way the urine cannot be voided;" but it is not so easy to admit that this view of the subject explains in a "natural and satisfactory manner" the periodicity of the normal uterine

contractions. A consideration of the molecular structure of the nervous tissues is essential to a thorough understanding of the conditions which cause uterine contraction, in common with all extraordinary nervous action, to assume an intermittent character.

There is reason for the belief that the substance of the nerves —and this is especially true of their ganglia—is composed of matter in which the molecules and atoms are in a state of exceedingly unstable equilibrium. It is this peculiarity of constitution that especially fits them for the reception and distribution of motion.

At the same time this condition of molecular instability implies a rapid rate of molecular disintegration whenever an unusual amount of motion is propagated through the medium of the nervous system. Unless made good by a corresponding process of nutrition, this process of disintegration will soon alter the constitution of a nerve-molecule to such an extent that it will no longer be composed of atoms arranged in a condition of unstable equilibrium. The stability of their equilibrium will increase till it approaches that which is characteristic of similar atoms in a molecule of inorganic (*dead*) matter. Hence, it follows that a nerve, or a nerve-centre, whose constituent molecules have become thus modified, is correspondingly unfitted for the reception and transmission of motion. Such a nerve, or nerve-centre, we say, is in a state of exhaustion; and it must rest for a time—that is, its original atomic and molecular constitution must be renovated by the processes of nutrition—before it can fully resume its function.

I am in the habit of illustrating these changes by reference to a common nursery game. Let us suppose a number of books placed on end at regular intervals in a row along the floor. If, now, the first one be upset, it will communicate its motion to the next, and so on to the last one, which by its fall will bring down a very considerable pile of volumes, whose overthrow may be reflected along another line in such a way as to work the utter destruction of an immense tower of blocks near the point at which all this commotion was originated. After the detached pieces have fallen from their unstable equilibrium into a position of stable equilibrium, you may

strike upon the first number of the series as hard a blow as you please without producing any such transfer of motion as was just now witnessed. But supposing each book to be furnished with some kind of a spring (*isomeric rearrangement of atoms within the molecule*) by which it can be restored to its original position as often as it may be upset, the same species of motion can then be propagated throughout the series for an indefinite period of time. If, however, with every downfall, a leaf or two is torn out of each volume, it will not be long before the propagation of motion over such a combination must necessarily be arrested by the wear and tear (*molecular concussion and atomic oxidation*) of its component pieces. A period of repose will then be inevitable; and it must continue until fresh volumes can be substituted (*process of nutrition*) for the old. The apparatus will then be as ready as ever for the reception and communication of motion.

A thoughtful consideration of this hypothesis* will enable anyone who is at all familiar with the atomic theory to entertain a rational conception of the cause of the intermittent character of uterine contraction; consequently, to the question which introduced this subject, we may thus reply:

*Because the nervous system is so constituted that extraordinary currents of impulse which seek distribution by its aid can only result in motion of an intermittent or rhythmical character.*

[The ideas advanced in the lecture published in this JOURNAL for April, 1875, by its senior editor, were not offered as affording a conclusive and positive statement of the mechanism of normal parturition and menstruation, but rather as a hypothesis, which though not absolutely established, yet sufficed better than perhaps any other to account for these phenomena; and, notwithstanding the objections of Dr. Lyman, we still consider the positions of that article as valid as when they were first proposed.

The latest, and best authorities on the question, still main-

*For an interesting discussion of the molecular physiology of nerve-action, I would refer the reader to the works of Herbert Spencer, and especially to the opening chapter of the first volume of his work on psychology.

tain that the neck of the uterus is practically obliterated at the time of parturition, in spite of the fact that its intra-vaginal projection may still be persistent and prominent, as was shown by the examinations of Dr. Taylor referred to. We are certainly far from agreeing with Dr. Lyman in his belief that at this time the cervix is "as good a sphincter" as it was before. Dr. Taylor, and his observations, certainly do not prove that the main body and cavity of the cervix in the primiparous uterus is not obliterated, and we do not see how it could be determined during life.

There is no reason, moreover, to exclude a certain amount of uterine contraction at all stages of pregnancy. This is suggested by Prof. Tarnier in his notes to Cazeaux, and is perfectly consistent with the hypothesis we have tried to develop. We might ask, also, why simple dilatation of the neck in the earlier period of gestation will induce premature labor, if it be not from a disturbance of the cervical tonicity without alteration of that of the body and fundus of the womb. The statement of Dr. Lyman, that the uterus tolerates its contents as long as the fœtal envelope forms an integral part of its substance, and, hence, that their separation must precede expulsive uterine contraction, is not supported by this fact, nor, in our opinion, by any other. He does not support it by argument, but states it, as it were, *ex cathedra*; nor does he quote any arguments in its favor, from Dr. C. C. P. Clarke, the originator, we believe, of this theory.

The facts of the settling of the womb in the pelvis shortly before, the behavior of the os during, labor, and the action of chloroform, which were referred to in the article in this JOURNAL, as supporting the reflex theory of parturition, do not at all support the view adopted above that the fœtus acts as a foreign body. There are also some facts, especially those of extra-uterine pregnancies, in which uterine contractions take place at term, that are extremely difficult to account for by any hypothesis which places the primal cause of labor within the body of the uterus, and which should, certainly, caution us against attributing too little importance to the nervous system, in the induction of this physiological phenomenon. Of all the theories that have been proposed, the one adopted by Dr.

Lyman, the blood theories of Dr. Brown-Sequard, and the one recently ennunciated by Dr. T. J. Mays, of New York, and the Power reflex theory, together with the adaptation of it proposed in the previous article in our JOURNAL, the latter, incomplete as it is in many respects, alone seems to us to be an approach to a satisfactory solution of the problem.—EDS.]

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## ART. VIII.—CASES OF INFANTILE PARALYSIS—PARAPLEGIA BY RHEUMATIC METASTASIS ENDING IN HEMIPLEGIA AND RECOVERY, AND CEREBRAL PARALYSIS.

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JOHNNY S., 2½ years old, was recommended to our office, by his physician, Dr. Correll, of Baltimore, January 23d, 1875; history: complete paralysis of the lower extremities, with tendency to double talipes varus; partial loss of sensation with lowering of temperature; and partial atrophy of the affected parts. The electro-muscular contractility, under the faradic current, poor; under galvanic current far better, so much so that we could offer a fair prognosis. The mother informed us that during the heat of the previous summer, the child, whilst cutting teeth, suffered great prostration. In the midst of this illness it was seized with a slight convulsion, and for several days following was comatose, but gradually improved from this condition, when she discovered that the child was paralyzed, as mentioned.

My mode of procedure was warm baths to the lower extremities, and daily lubrications as follows:

℞ Phosphori Solidi..... grs viii
Olei. Olivi Calidæ..... ℥ iv
Ft. Sol.

S. To be applied to the affected parts morning and evening, after thorough massage. Made application of galvanism as follows: A large